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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/944,186	09/04/2001	Atsushi Yamaguchi	PF-2871	1202

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EXAMINER

HU, SHOUXIANG

ART UNIT	PAPER NUMBER
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2811

DATE MAILED: 07/08/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/944,186

Applicant(s)

YAMAGUCHI ET AL.

Examiner

Shouxiang Hu

Art Unit

2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 April 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 71-80 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 71-80 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09 November 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 7.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of claims 71-80 in Paper No. 9 is acknowledged.

Information Disclosure Statement

2. The listing of references in the specification is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609 A(1) states, "the list may not be incorporated into the specification but must be submitted in a separate paper." Therefore, unless the references have been cited by the examiner on form PTO-892, they have not been considered.
3. The information disclosure statement filed on 01-03-02 (Paper No. 5) fails to comply with 37 CFR 1.98(a)(1), which requires a list of all patents, publications, or other information submitted for consideration by the Office, and also fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each U.S. and foreign patent; each publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. Neither list nor copy of references is found in the above information disclosure statement. During a conversation over the phone with the examiner on June 23, 2003, Mr. Robert J. Patch agreed to check into this issue; and no feedback has been received from him so far.

Drawings

4. New corrected drawings are required in this application because the drawings filed on 11-09-01 contain blurred lines and illegible letters, especially in Fig. 3. In addition, the term of "Eg fluctuation" in Figs. 7 and 8 should read as: "--standard deviation of Eg fluctuation--", according to the specification (see page 44, lines 7-10).

Applicant is advised to employ the services of a competent patent draftsman outside the Office, as the U.S. Patent and Trademark Office no longer prepares new drawings. The corrected drawings are required in reply to the Office action to avoid abandonment of the application. The requirement for corrected drawings will not be held in abeyance.

Specification

5. The disclosure is objected to because of numerous informalities and/or defects, which include but not limited to:

6. On page 3, lines 5 and 15, the unit of "millimeter(s)" appears to be in error.
7. On page 3, line 12, the unit of "micrometers" appears to be in error.
8. On page 8, line 3, the term of "he" should read as: "--the--".
9. On page 8, line 15, the unit of "micrometers" appears to be in error.
10. On page 9, line 2, the term of "outstanding" appears to be inappropriate therein.
11. On page 33, the sentence in lines 22-24 is hard to understand.
12. On page 34, lines 5-7, the term of "the life-time of" should read as: "--longer life-time for--".

13. On page 38, line 3, the word of "tends" appears to be inappropriate therein.
 14. On page 43, line 13, the phrase of "macroscopic fluctuation in the micro order" appears to be incomprehensible.
 15. On page 50, the paragraph in lines 6-10 appears to be in error.
 16. On page 61, line 9, the term of "pitting" should read as: --fitting--.
 17. On page 61, the phrase in lines 20-23 appears to be self-contradictory.
 18. On page 70, line 1, the term of "to difficult" should read as: --to be difficult--.
 19. On page 72, line 3, the term of "an" should read as: --and--.
 20. On page 74, line 6, the unit of "micrometers" appears to be in error.
 21. On pages 74 and 80, no descriptions are provided for the terms of "TMG", "TMA" and "TMI".
 22. On page 79, line 16, the unit of "micrometers" appears to be in error.
- Thorough proof reading and appropriate correction are required.

Claim Rejections - 35 USC § 112

23. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

24. Claims 71-80 are rejected under 35 U.S.C. 112, first paragraph, as based on a disclosure which is not enabling. Certain features are critical or essential to the practice of the invention, but not included in the claim(s). See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976). Those features include: the macroscopic fluctuation in

Art Unit: 2811

the composition in the quantum well of the active region remains "small"; an undoped GaN optical confinement; and, the standard deviation of a microscopic fluctuation in the composition in the quantum well of the active region is not more than 40 meV. Those features are critical to obtain the recited performance parameters of the claimed invention (including the recited threshold mode gain, differential gain, internal loss, and slope efficiency), according to the specification (see pages 81-82 in particular) and the drawings (see Fig. 10 in particular).

25. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

26. Claims 71-80 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 recites a quantum well and a luminescent layer, but fails to clarify what is the relationship between them. According to the specification (see page 79, lines 11-18), the quantum well is at least a part of the luminescent layer.

In addition, Claims 71-81 are further rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential elements, such omission amounting to a gap between the elements. See MPEP § 2172.01. The omitted elements are: key device structure features including its material set (especially the materials for the substrate, the active region and the confinement regions) and the thicknesses and doping concentrations of the individual layers (especially the layers in

Art Unit: 2811

the active region), since these elements are strongly correlated with the recited performance parameters of the claimed invention (including the recited threshold mode gain, differential gain, internal loss, and slope efficiency).

Furthermore, claim 76 fails to clearly define what is the layer in which the photoluminescence peak wavelength distribution is measured for.

Claim Rejections - 35 USC § 102

27. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

28. Claims 71-73, 76, 77 and 79, insofar as being in compliance with 35 U.S.C. 112, are rejected under 35 U.S.C. 102(e) as being anticipated by Domen et al. ("Domen"; US 6,555,403).

Domen discloses a semiconductor device having a semiconductor multi-layer structure (particularly see Figs. 5 and 19-20, and col. 24, lines 34-40, col. 25, lines 45-55, col. 26, line 2, through col. 27, line 64, and col. 63, lines 23-24), comprising an active layer (16) having a quantum well ($\text{In}_{0.5}\text{Ga}_{0.85}\text{N}$) as part of a luminescent layer (an $\text{In}_x\text{Al}_y\text{Ga}_{1-x-y}\text{N}$ layer, with $y=0$), wherein a threshold mode gain of the single quantum well can be more than 12 cm^{-1} (see G_{th} in Fig. 19; also see "MODEAL GAIN" in Fig. 5).

Art Unit: 2811

And, Domen further discloses that the photo-luminescence peak wavelength distribution for the active layer is less than 20 meV (col. 25, lines 53055), or as low as 5 meV (col. 24, lines 34-40). Accordingly, the photo-luminescence peak wavelength distribution for the active layer in Domen can be far less than 40 meV, as the one recited in claim 74 of the instant invention, and even much lower than 17 meV, as the one provided in the best mode of the instant invention (see page 82, lines 22 and 23). Thus, the microscopic fluctuation in active layer in Domen can be naturally lower than that in the instant invention. Therefore, the differential gain (dg/dn) in Domen can be naturally no less than $10^{-20} \text{ (m}^2\text{)}$, according to the inherent relationship between the differential gain and the microscopic fluctuation shown in Fig. 10 of the instant invention.

Regarding claim 73, the recited relationship between the internal loss and the mirror loss can be naturally met in Domen, provided that the threshold mode gain (which by definition equals to the sum of the internal loss and the mirror loss) of the single quantum well is more than 12 cm^{-1} .

Regarding claim 79, Domen further discloses that the substrate can be sapphire (col. 63, lines 23-24).

Claim Rejections - 35 USC § 103

29. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

30. Claims 74, 75, 78 and 80, insofar as being in compliance with 35 U.S.C. 112, are rejected under 35 U.S.C. 103(a) as being unpatentable over Domen et al. ("Domen"; US 6,555,403) in view of Razeghi (US 6,459,096) and/or applicant's admitted prior art ("AAPA").

The disclosure of Domen is discussed as applied to claims 71-73, 76, 77 and 79 above.

Domen does not expressly disclose that the semiconductor laser device can have a cavity length "L" of not less than 1000 micrometers, that the reflectance of the first facet is not more than 20%, and the reflectance of the second facet is not less than 80% and less than 100%; and that the substrate can also be GaN. However, one of ordinary skill in the art would readily recognize that longer cavity length can desirably reduce the threshold current density and increase the output, as evidenced in Razeghi (see Fig. 6, in which the cavity length can be larger than 1 mm); that one of the facets can be desirably coated to have a high reflectance in order to reduce the threshold current density in the laser and increase the optical output from the uncoated output facet, as evidenced AAPA (see page 6, line 21, through page 7, line 1; in which the coated facet has a reflectance of 95%. And, it is noted that the uncoated facet would inherently have a reflectance of less than 20% (see page 70, lines 8-14, in the instant specification)); and that the GaN-based multiple layers can be directed formed on a GaN substrate for better lattice match therebetween, as also evidenced in AAPA (see the GaN substrate 121 in Fig. 2).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the above-1-mm cavity length of Razeghi and the single-facet coated mirror and the GaN substrate of AAPA into the semiconductor laser device of Domen, so that a laser device with reduced threshold current density, improved optical output and reduced defects in the active layer would be obtained.

Regarding claims 74 and 75, the recited limitations for the slope efficiency would be naturally met in the above collectively taught laser device, since the reflectances of the paired facets and the cavity length (they together also determines the mirror loss) in the above collectively taught laser device would be substantially the same as that in the instant invention.

Regarding claim 80, it is noted that it is art-recognized that low surface dislocation density in the substrate is very critical for the epitaxial growth of high quality multiple GaN-based layers; and that a surface dislocation density of lower than $10^8/\text{cm}^2$ can be readily achieved for a GaN substrate, since even in a derived GaN substrate the surface dislocation density can be already as low as about $10^6/\text{cm}^2$ or lower (as evidenced in the prior art such as Tsuda et al., US 6,294,440; see col. 2, lines 25-29).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Reference C is cited as being related to a GaN-based laser device.

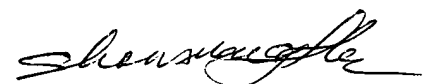
Art Unit: 2811

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shouxiang Hu whose telephone number is (703) 306-5729. The examiner can normally be reached on Monday through Thursday, 7:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (703) 308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9318 for regular communications and (703) 872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

SH
June 26, 2003



Shouxiang Hu
Patent Examiner
TC2800